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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Patent Application of:)
Kumamoto, et al.)
Serial No.: 09/741,535) Examiner: Thai, Luan C.
Filed: December 19, 2000) Art Unit: 2827
For: MOLDED FLIP CHIP PACKAGE)

RESPONSE TO OFFICE ACTION

Box Non-Fee Amendment
Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

In response to the Office Action mailed April 3, 2002, the Applicants
respectfully request the Examiner to enter the following amendment and to
consider the following remark.

FIRST CLASS CERTIFICATE OF MAILING

I hereby certify that I am causing the above-referenced correspondence to be deposited with the
United States Postal Service as first class mail with sufficient postage on the date indicated below
and that this paper or fee has been addressed to the Assistant Commissioner for Patents,
Washington, D. C. 20231

May 1, 2002

Date of Deposit

Debbie Peloquin

Name of Person Mailing Correspondence

Debbie Peloquin

Signature

5-1-02

Date

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AMENDMENT

Unmarked Version

Presented below are the amended claims in a clean-unmarked version.

For the Examiner's convenience all pending claims are presented herein.

Please amend the claims as follows:

1. (Once Amended) A method comprising:

placing incomplete chip package into a mold formed by a first portion and a second portion, the incomplete chip package comprising a chip and a substrate electrically coupled using a flip chip process, the chip having (i) a top surface facing the substrate, (ii) a bottom surface opposite the top surface, and (iii) one or more side surfaces between the top and bottom surfaces;

injecting a liquid resin into a runner section of the mold, the runner formed between the first portion and the second portion, and the resin encapsulating a significant portion of the one or more side surfaces, and filling a first gap between the top surface and the adjacent substrate; and

curing the resin.

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cancel*

2. (Once Amended) The method of claim 1, wherein the chip and substrate are electrically coupled by a plurality of reflowed solder bumps.

3. The method of claim 1, wherein the incomplete chip package further comprises at least one passive component electrically coupled to the substrate.

4. The method of claim 1, wherein the resin comprises an epoxy.

5. The method of claim 4, wherein the resin further comprises a filler material.

6. The method of claim 5, wherein the filler material comprises silica spheres.

7. The method of claim 1, wherein the resin is injected under pressure.

8. The method of claim 1, wherein the resin encapsulates substantially all of the one or more side surfaces.

9. The method of claim 8, wherein the resin does not encapsulate the bottom surface.

10. The method of claim 1, wherein the mold comprises an upper mold cavity surface, and the bottom surface butts directly up against an adjacent portion of the upper mold cavity surface.

11. The method of claim 10, wherein a release film intervenes between the bottom surface and the upper mold cavity surface.

12. The method of claim 1, wherein the mold is maintained at an elevated temperature during said operation of injecting a liquid resin into the mold.

13. The method of claim 1, wherein the resin is cured by maintaining the resin at an elevated temperature for at least a predetermined period of time.

14. The method of claim 1, wherein the substrate is a thin substrate.

15. The method of claim 1, wherein the substrate is comprised of a polymeric material.

16. The method of claim 14, wherein the thin substrate is approximately 0.05mm to 0.5mm thick.

17. The method of claim 3, wherein said injecting a liquid resin into the mold also fills at a second gap between a first surface of the at least one passive component and an adjacent surface of the substrate.

18. The method of claim 3, wherein said injecting a liquid resin into the mold fully encapsulates the at least one passive component.

19. A flip chip package made according to the process of claim 1.

20. (Once Amended) A method comprising:

placing an incomplete flip chip package into a bottom inner cavity of a bottom mold portion,

the incomplete flip chip package comprising a chip and a substrate, the chip having a top surface coupled by reflowed solder bumps to a upper surface of the substrate, the chip further comprising a bottom surface opposite the top surface and one or more side surfaces between the top and bottom surfaces;

mating an upper mold portion with the lower mold portion, the upper mold portion having an upper inner cavity, the upper and bottom inner cavities forming a mold inner cavity enclosing the incomplete flip chip

package, and forming a runner between the upper and lower mold portions;

injecting a predetermined amount of a liquid resin into the mold inner cavity through the runner, the liquid resin encapsulating substantially all of the one or more side surfaces and substantially all of the upper surface, the liquid resin further filling a gap between the top surface of the chip and an adjacent portion of the upper surface, encapsulating the reflowed solder bumps;

curing the liquid resin by maintaining the mold at an elevated temperature for a predetermined period of time, the elevated temperature being equal to or greater than the cure temperature of the filled liquid resin for the predetermined period of time.

21. The method of claim 20, wherein the liquid resin comprises an epoxy and a silica filler.
22. The method of claim 20, wherein the substrate is a thin substrate having an approximate thickness of 0.05mm to 0.5mm.
23. The method of claim 20 further comprising:

removing the complete flip chip package from the mold inner cavity by separating the upper and bottom mold portions, the complete flip chip package comprising the incomplete flip chip package and the solidified filled resin adhesively bonded to the incomplete flip chip package.

24. A flip chip package produced using the process of claim 20.
25. The method of claim 20, wherein the bottom surface butts against an adjacent surface of the upper inner cavity.
26. The method of claim 25, wherein a release film intervenes between the bottom surface and the adjacent surface of the upper inner cavity.

Please add the following new claims:

31. The method of claim 1, wherein the mold comprising air vents located opposite the runner.
32. The method of claim 20, wherein the mold comprising air vents located opposite the runner.

Remark

Applicant respectfully requests reconsideration of this application as amended. Claims 1, 2 and 20 have been amended, and claims 31 and 32 have been added. No claims have been cancelled. Therefore, claims 1-26 and 31-32 are present for examination.

35 U.S.C. §102 Rejection

Chia et al.

The Examiner has rejected claims 1-2, 4-10, 12-14 and 19 under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,081,997 of Chia et al. (hereinafter “Chia”).

Chia discloses a method for packaging an integrated circuit using encapsulant injection. In Chia, liquid encapsulant is injected into a first mold section through an opening of the first mold section to fill openings of the substrate, and cavity of the second mold section, as well as to envelope solder bumps.

The Applicants respectfully disagree with the Examiner that claims 1-2, 4-10, 12-14 and 19 as amended are anticipated by Chia. Since claims 2, 4-10, 12-14, and 19 depend, directly or indirectly from claim 1, and therefore inherit the limitations of claim 1, each of claims 1-2, 4-10, 12-14 and 19 requires that resin be injected through a “runner” in the mold that is formed between a first mold portion and a second mold portion. As discussed on page 6, lines 19-20 of the Application, a “runner 230 is formed at the intersection of both mold halves

through which resin may be injected". See also FIGS. 2c and 2d in which the runner (230) is illustrated as being formed between the mold halves (210 and 220).

Chia does not disclose a runner through which resin can be injected.

Instead, Chia discloses an "[o]pening 22 of first mold section 20" to receive a liquid encapsulant (Chia, column 6, lines 9-11). In Chia, the opening through which resin is injected exists on a single mold portion, and is not formed by mold halves. As such, Chia does not disclose a "runner" through which resin can be injected as required by the Applicants' invention as recited by claims 1-2, 4-10, 12-14 and 19.

Since Chia does not disclose each and every element of claims 1-2, 4-10, 12-14 and 19, Chia does not anticipate the Applicants' invention as recited by these claims. For at least these reasons, the Applicants respectfully request that the Examiner's rejection be withdrawn and the claims as amended be allowed.

35 U.S.C. §103 Rejection

Chia et al. in combination with Baba et al.

The Examiner has rejected claims 3 and 17-18 under 35 U.S.C. 103(a) as being unpatentable over Chia et al in combination with U.S. Patent No. 6,071,755 of Baba et al. hereinafter "Baba").

Baba discloses a semiconductor device that includes a substrate encapsulated by a resin, a lead pattern or laminated wiring layers transferred on

the lower surface of the resin, and external electrodes disposed on the lower surface of the lead pattern.

Since claims 3 and 17-18 depend, directly or indirectly, from claim 1, and inherit the limitations of claim 1 and add further limitations; and since it is believed that the rejection to claim 1 has been overcome; and since Baba does not disclose that which is missing from Chia, the Applicants respectfully request that the Examiner's rejection of claims 3 and 17-18 be withdrawn and that the claims as amended be allowed.

Chia et al. in view of Lin et al.

The Examiner has rejected claims 11, 15, 20-21 and 23-26 under 35 U.S.C. 103(a) as being unpatentable over Chia et al. in view of U.S. Patent No. 5,540,283 of Lin et al. hereinafter ("Lin").

Lin discloses a thermally enhanced semiconductor device.

Since claims 11 and 15 depend, directly or indirectly, from claim 1, and inherit the limitations of claim 1 and add further limitations; and since it is believed that the rejection to claim 1 has been overcome; and since Lin does not disclose that which is missing from Chia, the Applicants respectfully request that the Examiner's rejection of claims 11 and 15 be withdrawn and that the claims as amended be allowed.

With respect to claims 20-21, and 23-26, since claims 21, and 23-26 depend, directly or indirectly from claim 20, and therefore inherit the limitations of claim 20, each of claims 20-21 and 23-26 requires that resin be injected through

a "runner" in the mold that is formed between a first mold portion and a second mold portion. (See discussion above.) Since Chia does not disclose this, and since Lin does not disclose that which is missing from Chia, Chia and Lin cannot be combined to form the Applicants' invention as recited by claims 20-21, and 23-26. As such, the Applicants respectfully request that the Examiner's rejection of these claims be withdrawn, and that the claims as amended be allowed.

Chia et al. in view of Lin et al. in view of Glenn et al.

The Examiner has rejected claims 16 and 22 under 35 U.S.C. 103(a) as being unpatentable over Chia et al. in view of Lin et al. and further in view of U.S. Patent No. 5,981,314 of Glenn et al. hereinafter ("Glenn").

Glenn discloses a method for simultaneously fabricating a plurality of integrated circuit chip (IC chip) packages from a single insulating substrate having sections.

Since claims 16 and 22 depend, directly or indirectly, from claims 1 and 20, respectively, and inherit the limitations of claims 1 and 20, and add further limitations; and since it is believed that the rejection to claims 1 and 20 have been overcome; and since Glenn does not disclose that which is missing from Chia, the Applicants respectfully request that the Examiner's rejection of claims 16 and 22 be withdrawn and that the claims as amended be allowed.

New Claims 31-32

Applicants respectfully submit that new claims 31 and 32 do not add any new matter, and are fully supported by the original specification. With respect to claims 31 and 32, which require that the mold includes “air vents located opposite the runner”, the Applicants respectfully point out to the Examiner that none of the references teaches or suggests a mold having air vents that are located opposite a runner. In particular, while Chia discloses air vents, the air vents of Chia are located on the underside of a mold portion. Furthermore, Chia does not teach or disclose a “runner” portion of the mold through which resin can be injected (discussed *supra*), and in which air vents can be located opposite of.

Conclusion

Applicants respectfully submit that the rejections have been overcome by the amendment and remark, and that the claims as amended are now in condition for allowance. Accordingly, Applicants respectfully request the rejections be withdrawn and the claims as amended be allowed.

Invitation for a Telephone Interview

The Examiner is requested to call the undersigned at (303) 740-1980 if there remains any issue with allowance of the case.

Request for an Extension of Time

The Applicants respectfully petition for an extension of time to respond to the outstanding Office Action pursuant to 37 C.F.R. § 1.136(a) should one be necessary. Please charge our Deposit Account No. 02-2666 to cover the necessary fee under 37 C.F.R. § 1.17 for such an extension.

Charge our Deposit Account

Please charge any shortage to our Deposit Account No. 02-2666.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Date: May 1, 2002



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